AD-A167 591 CHEMICAL WARFARE-BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS(U) DEPUTY CHIEF OF STAFF FOR RESEARCH DEVELOPMENT AND ACQUISITION (ARMY) WASHINGTON D C 1/1

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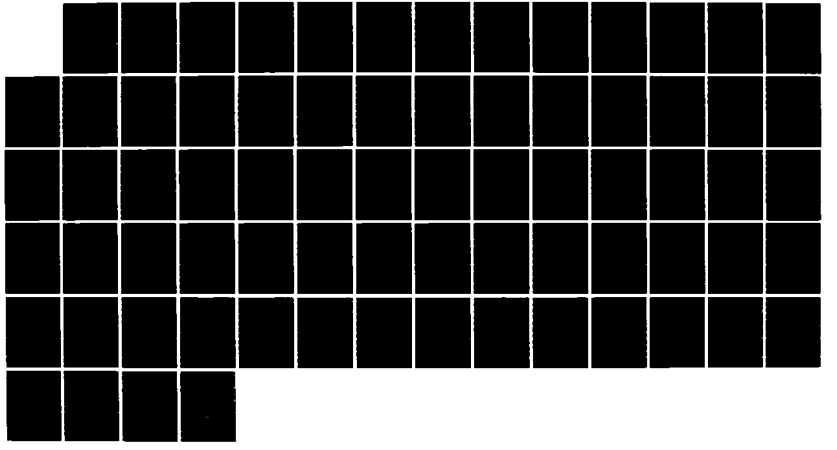

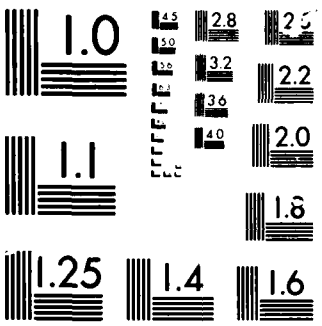

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AD-A167 591

DOCUMENTATION PAGE

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1b RESTRICTIVE MARKINGS

3 DISTRIBUTION / AVAILABILITY OF REPORT

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4 PERFORMING ORGANIZATION REPORT NUMBER(S)

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5 MONITORING ORGANIZATION REPORT NUMBER(S)

6a NAME OF PERFORMING ORGANIZATION

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7a NAME OF MONITORING ORGANIZATION

6c ADDRESS (City, State, and ZIP Code)

The Pentagon
Washington, D.C. 20310

7b ADDRESS (City, State, and ZIP Code)

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8a NAME OF FUNDING / SPONSORING ORGANIZATION

8b OFFICE SYMBOL (If applicable)

9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER

8c ADDRESS (City, State, and ZIP Code)

10 SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)

DEPARTMENT OF DEFENSE ANNUAL REPORT ON CHEMICAL WARFARE-BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

12 PERSONAL AUTHOR(S)

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
ANNUAL	FROM 82/10/1 TO 83/9/30	1983 December	

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	OBLIGATIONS	PUBLIC LAW 91-121	FY 83
15	02		CHEMICAL	PUBLIC LAW 93-608	
			BIOLOGICAL	PUBLIC LAW 97-375	

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

Public Law 93-608 requires the Department of Defense to make an annual report to Congress on the funds obligated for chemical warfare and biological defense research and procurement programs.

DTIC FILE COPY

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT

☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS

21 ABSTRACT SECURITY CLASSIFICATION

UNCLASSIFIED

22a NAME OF RESPONSIBLE INDIVIDUAL	22b TELEPHONE (Include Area Code)	22c OFFICE SYMBOL
ROBERT J. HARTMAN	(202) 694-2153	DAMA-CSS-C

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

INSTRUCTIONS FOR PREPARATION OF REPORT DOCUMENTATION PAGE

GENERAL INFORMATION

The accuracy and completeness of all information provided in the DD Form 1473, especially classification and distribution limitation markings, are the responsibility of the authoring or monitoring DoD activity.

Because the data input on this form will be what others will retrieve from DTIC's bibliographic data base or may determine how the document can be accessed by future users, care should be taken to have the form completed by knowledgeable personnel. For better communication and to facilitate more complete and accurate input from the originators of the form to those processing the data, space has been provided in Block 22 for the name, telephone number, and office symbol of the DoD person responsible for the input cited on the form.

All information on the DD Form 1473 should be typed.

Only information appearing on or in the report, or applying specifically to the report in hand, should be reported. If there is any doubt, the block should be left blank.

Some of the information on the forms (e.g., title, abstract) will be machine indexed. The terminology used should describe the content of the report or identify it as precisely as possible for future identification and retrieval.

NOTE: **Unclassified abstracts and titles describing classified documents may appear separately from the documents in an unclassified context, e.g., in DTIC announcement bulletins and bibliographies. This must be considered in the preparation and marking of unclassified abstracts and titles.**

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SECURITY CLASSIFICATION OF THE FORM

In accordance with DoD 5200.1-R, Information Security Program Regulation, Chapter IV Section 2, paragraph 4-200, classification markings are to be stamped, printed, or written at the top and bottom of the form in capital letters that are larger than those used in the text of the document. See also DoD 5220.22-M, Industrial Security Manual for Safeguarding Classified Information, Section II, paragraph 11a(2). This form should be unclassified, if possible.

SPECIFIC BLOCKS

Block 1a. Report Security Classification: Designate the highest security classification of the report. (See DoD 5220.1-R, Chapters I, IV, VII, XI, Appendix A.)

Block 1b Restricted Marking: Enter the restricted marking or warning notice of the report (e.g., CNWDI, RD, NATO).

Block 2a Security Classification Authority: Enter the commonly used markings in accordance with DoD 5200.1-R, Chapter IV, Section 4, paragraph 4-400 and 4-402. Indicate classification authority.

Block 2b Declassification / Downgrading Schedule: Indicate specific date or event for declassification or the notation, "Originating Agency Determination Required" or "OADR." Also insert (when applicable) downgrade to _____ on _____ (e.g., Downgrade to Confidential on 6 July 1983). (See also DoD 5220.22-M, Industrial Security Manual for Safeguarding Classified Information, Appendix II.)

NOTE: **Entry must be made in Blocks 2a and 2b except when the original report is unclassified and has never been upgraded.**

Block 3 Distribution/Availability Statement of Report: Insert the statement as it appears on the report. If a limited distribution statement is used, the reason must be one of those given by DoD Directive 5200.20, Distribution Statements on Technical Documents, as supplemented by the 18 OCT 1983 SECDEF Memo, "Control of Unclassified Technology with Military Application." The Distribution Statement should provide for the broadest distribution possible within limits of security and controlling office limitations.

Block 4 Performing Organization Report Number(s): Enter the unique alphanumeric report number(s) assigned by the organization originating or generating the report from its research and whose name appears in Block 6. These numbers should be in accordance with ANSI STD 239.23-74, "American National Standard Technical Report Number." If the Performing Organization is also the Monitoring Agency, enter the report number in Block 4.

Block 5 Monitoring Organization Report Number(s): Enter the unique alphanumeric report number(s) assigned by the Monitoring Agency. This should be a number assigned by a DoD or other government agency and should be in accordance with ANSI STD 239.23-74. If the Monitoring Agency is the same as the Performing Organization, enter the report number in Block 4 and leave Block 5 blank.

Block 6a Name of Performing Organization: For in-house reports, enter the name of the performing activity. For reports prepared under contract or grant, enter the contractor or the grantee who generated the report and identify the appropriate corporate division, school, laboratory, etc., of the author.

Block 6b. Office Symbol: Enter the office symbol of the Performing Organization.

Block 6c Address: Enter the address of the Performing Organization. List city, state, and ZIP code.

Block 7a Name of Monitoring Organization: This is the agency responsible for administering or monitoring a project, contract, or grant. If the monitor is also the Performing Organization, leave Block 7a blank. In the case of joint sponsorship, the Monitoring Organization is determined by advance agreement. It can be either an office, a group, or a committee representing more than one activity, service, or agency.

Block 7b Address: Enter the address of the Monitoring Organization. Include city, state, and ZIP code.

Block 8a Name of Funding/Sponsoring Organization. Enter the full official name of the organization under whose immediate funding the document was generated, whether the work was done in-house or by contract. If the Monitoring Organization is the same as the Funding Organization, leave 8a blank.

Block 8b Office Symbol: Enter the office symbol of the Funding/Sponsoring Organization.

Block 8c Address: Enter the address of the Funding/Sponsoring Organization. Include city, state and ZIP code.

Block 9 *Procurement Instrument Identification Number*: For a contractor grantee report, enter the complete contract or grant number(s) under which the work was accomplished. Leave this block blank for in-house reports.

Block 10 Source of Funding (Program Element, Project, Task Area, and Work Unit Number(s)): These four data elements relate to the DoD budget structure and provide program and/or administrative identification of the source of support for the work being carried on. Enter the program element, project, task area, work unit accession number, or their equivalents which identify the principal source of funding for the work required. These codes may be obtained from the applicable DoD forms such as the DD Form 1498 (Research and Technology Work Unit Summary) or from the fund citation of the funding instrument. If this information is not available to the authoring activity, these blocks should be filled in by the responsible DoD Official designated in Block 22. If the report is funded from multiple sources, identify only the Program Element and the Project, Task Area, and Work Unit Numbers of the principal contributor.

Block 11. Title: Enter the title in Block 11 in initial capital letters exactly as it appears on the report. Titles on all classified reports, *whether classified or unclassified, must be immediately* followed by the security classification of the title enclosed in parentheses. A report with a classified title should be provided with an unclassified version if it is possible to do so without changing the meaning or obscuring the contents of the report. Use specific, meaningful words that describe the content of the report so that when the title is machine-indexed, the words will contribute useful retrieval terms.

If the report is in a foreign language and the title is given in both English and a foreign language, list the foreign language title first, followed by the English title enclosed in parentheses. If part of the text is in English, list the English title first followed by the foreign language title enclosed in parentheses. If the title is given in more than one foreign language, use a title that reflects the language of the text. If both the text and titles are in a foreign language, the title should be translated, if possible, unless the title is also the name of a foreign periodical. Transliterations of often used foreign alphabets (see Appendix A of MIL-STD-8478) are available from DTIC in document AD-A080 800.

Block 12. Personal Author(s): Give the complete name(s) of the author(s) in this order: last name, first name, and middle name. In *addition, list the affiliation of the authors if it differs from that of* the performing organization.

List all authors. If the document is a compilation of papers, it may be more useful to list the authors with the titles of their papers as a contents note in the abstract in Block 19. If appropriate, the names of editors and compilers may be entered in this block.

Block 13a Type of Report: Indicate whether the report is summary, final, annual, progress, interim, etc.

Block 13b Time Covered: Enter the inclusive dates (*year, month, day*) of the period covered, such as the life of a contract in a final contractor report.

Block 14 Date of Report: Enter the year, month, and day, or the year and the month the report was issued as shown on the cover.

Block 15 Page Count: Enter the total number of pages in the report that contain information, including cover, preface, table of contents, distribution lists, partial pages, etc. A chart in the body of the report is counted even if it is unnumbered.

Block 16 Supplementary Notation: Enter useful information about the report in hand, such as: "Prepared in cooperation with ." "Translation of (or by) ." "Symposium ." If there are report numbers for the report which are not noted elsewhere on the form (such as internal series numbers or participating organization report numbers) enter in this block.

Block 17. COSATI Codes: This block provides the subject coverage of the report for announcement and distribution purposes. The categories are to be taken from the "COSATI Subject Category List" (DoD Modified), Oct 65, AD 624 000. A copy is available on request to any organization generating reports for DoD. At least one entry is required as follows:

Field - to indicate subject coverage of report.

Group - to indicate greater subject specificity of information in the report.

Sub-Group - if specificity greater than that shown by Group is required, use further designation as the numbers after the period (.) in the Group breakdown. Use only the designation provided by AD-624 000.

Example: The subject "Solid Rocket Motors" is Field 21, Group 08, Subgroup 2 (page 32, AD-624 000).

Block 18. Subject Terms: These may be descriptors, keywords, posting terms, identifiers, open-ended terms, subject headings, acronyms, code words, or any words or phrases that identify the principal subjects covered in the report, and that conform to standard terminology and are exact enough to be used as subject index entries. Certain acronyms or "buzz words" may be used if they are recognized by specialists in the field and have a potential for becoming accepted terms. "Laser" and "Reverse Osmosis" were once such terms.

If possible, this set of terms should be selected so that the terms individually and as a group will remain UNCLASSIFIED without losing meaning. However, priority must be given to specifying proper subject terms rather than making the set of terms appear "UNCLASSIFIED." Each term on classified reports must be immediately followed by its security classification, enclosed in parentheses.

For reference on standard terminology the "DTIC Retrieval and Indexing Terminology" DRIT-1979, AD-A068 500, and the DoD "Thesaurus of Engineering and Scientific Terms (TEST) 1968, AD-672 000, may be useful.

Block 19 Abstract: The abstract should be a pithy, brief (preferably not to exceed 300 words), factual summary of the most significant information contained in the report. However, since the abstract may be machine-searched, all specific and meaningful words and phrases which express the subject content of the report should be included, even if the word limit is exceeded.

If possible, the abstract of a classified report should be unclassified and consist of publicly releasable information (Unlimited), but in no instance should the report content description be sacrificed for the security classification.

NOTE: **An unclassified abstract describing a classified document may appear separately from the document in an unclassified context e.g., in DTIC announcement or bibliographic products. This must be considered in the preparation and marking of unclassified abstracts.**

For further information on preparing abstracts employing scientific symbols, verbalizing, etc., see paragraphs 2.1(n) and 2.3(b) in MIL-STD-847B.

Block 20. Distribution / Availability of Abstract: This block must be completed for all reports. Check the applicable statement: "unclassified / unlimited," "same as report," or if the report is available to DTIC registered users "DTIC users."

Block 21. Abstract Security Classification: To ensure proper safeguarding of information, this block must be completed for all reports to designate the classification level of the entire abstract. For CLASSIFIED abstracts, each paragraph must be preceded by its security classification code in parentheses.

Block 22a,b,c. Name, Telephone and Office Symbol of Responsible Individual: Give name, telephone number, and office symbol of DoD person responsible for the accuracy of the completion of this form.

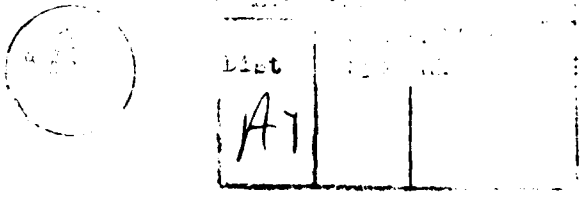
DEPARTMENT OF DEFENSE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

RCS: DD-DR&E (SA) 1065



DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS
FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983
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DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS
FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983
RCS: DD-DR&E(SA) 1065

(ACTUAL DOLLARS)

	ARMY	NAVY AND MARINE CORPS	AIR FORCE	TOTAL
CHEMICAL WARFARE PROGRAM	**116,932,000**	**20,321,000**	**26,118,000**	**163,371,000**
RDTE	116,932,000	20,321,000	26,118,000	163,371,000
PROCUREMENT	-0-	-0-	-0-	-0-
BIOLOGICAL RESEARCH PROGRAM	**37,705,000**	**1,097,000**	**-0-**	**38,802,000**
RDTE	37,705,000	1,097,000	-0-	38,802,000
PROCUREMENT	-0-	-0-	-0-	-0-
ORDNANCE PROGRAM	**22,337,000**	**-0-**	**-0-**	**22,337,000**
RDTE	8,955,000	-0-	-0-	8,955,000
PROCUREMENT	13,382,000	-0-	-0-	13,382,000
TOTAL PROGRAM	**176,974,000**	**21,418,000**	**26,118,000**	**224,510,000**
RDTE	163,592,000	21,418,000	26,118,000	211,128,000
PROCUREMENT	13,382,000	-0-	-0-	13,382,000

DEPARTMENT OF DEFENSE

ANNUAL REPORT ON CHEMICAL WARFARE AND

BIOLOGICAL DEFENSE RESEARCH HUMAN TESTING

1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

There have been no studies conducted within the Department of Defense during the reporting period that involved the use of human subjects for testing of Chemical or Biological agents.

ANNEX A

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

RCS: DD-DR&E (SA) 1065

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

SECTION I

OBLIGATION REPORT ON CHEMICAL WARFARE PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARTMENT OF THE ARMY

RCS: DD-DR&E (SA) 1065

DESCRIPTION OF RDTE EFFORT FOR THE CHEMICAL WARFARE PROGRAM

During FY83, the Department of the Army obligated $116,932,000 for general research investigations, development and test of chemical warfare agents, weapons systems and defensive equipment.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$113,578,000	
Prior Year (PY)	3,354,000	
		In-House $ 59,462,000
TOTAL	$116,932,000	Contract $ 57,470,000

Breakdown of Program Areas

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences	CFY	$ 10,228,000	
	PY	-0-	
			In-House $ 6,401,000
		$ 10,228,000	Contract $ 3,827,000
b. Exploratory Development	CFY	$ 10,589,000	
	PY	-0-	
			In-House $ 7,874,000
		$ 10,589,000	Contract $ 2,715,000
TOTAL: CHEMICAL RESEARCH	CFY	$ 20,817,000	
	PY	-0-	
			In-House $ 14,275,000
		$ 20,817,000	Contract $ 6,542,000

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development	CFY	$ 7,367,000		
	PY	-0-		
			In-House	$ 6,097,000
	$	7,367,000	Contract	$ 1,270,000
b. Advanced Development	CFY	$ 346,000		
	PY	1,168,000		
			In-House	$ 1,514,000
	$	1,514,000	Contract	
c. Engineering Development	$	-0-		
d. Testing	$	-0-		
TOTAL: LETHAL CHEMICAL PROGRAM	CFY	$ 7,713,000		
	PY	1,168,000		
			In-House	$ 7,611,000
	$	8,881,000	Contract	$ 1,270,000

3. INCAPACITATING CHEMICAL PROGRAM

a. Exploratory Development	CFY	$	380,000		
	PY		-0-		
		$	380,000	In-House $	337,000
				Contract $	43,000
b. Advanced Development		$	-0-		
c. Engineering Development		$	-0-		
d. Testing		$	-0-		

TOTAL: INCAPACITATING CHEMICAL PROGRAM	CFY	$	380,000		
	PY	$	-0-		
		$	380,000	In-House $	337,000
				Contract $	43,000

4. DEFENSIVE EQUIPMENT PROGRAM

a. Exploratory Development

(1) Physical Protection Investigations	CFY	$	10,760,000		
	PY		-0-		
		$	10,760,000	In-House $	7,070,000
				Contract $	3,690,000
(2) Warning and Detection Investigations	CFY	$	11,549,000		
	PY		-0-		
		$	11,549,000	In-House $	6,136,000
				Contract $	5,413,000

(3) Medical Defense Against Chemical Agents	CFY	$ 18,723,000		
	PY	1,659,000		
			In-House	$10,745,000
		$ 20,382,000	Contract	$ 9,637,000
TOTAL: Exploratory Development	CFY	$ 41,032,000		
	PY	1,659,000		
			In-House	$23,951,000
		$ 42,691,000	Contract	$18,740,000
b. Advanced Development				
(1) Defensive Systems	CFY	$ 21,710,000		
	PY	229,000		
			In-House	$ 5,466,000
		$ 21,939,000	Contract	$16,473,000
(2) Medical Defense Against Chemical Agents	CFY	$ 11,520,000		
	PY	298,000		
			In-House	$ 1,782,000
		$ 11,818,000	Contract	$10,036,000
TOTAL: Advanced Development	CFY	$ 33,230,000		
	PY	527,000	In-House	$ 7,248,000
		$ 33,757,000	Contract	$26,509,000

c. Engineering Development

(1) Decontamination Concepts and Material	CFY	$ 1,498,000		
	PY	-0-		
			In-House	$ 913,000
	$	1,498,000	Contract	$ 585,000
(2) Collective Protection Systems	CFY	$ 1,753,000		
	PY	-0-		
			In-House	$ 1,442,000
	$	1,753,000	Contract	$ 311,000
(3) Warning and Detection Equipment	CFY	$ 650,000		
	PY	-0-		
			In-House	$ 313,000
	$	650,000	Contract	$ 337,000
(4) Individual Protection Equipment	CFY	$ 4,039,000		
	PY	-0-		
			In-House	$ 1,403,000
	$	4,039,000	Contract	$ 2,636,000
TOTAL: Engineering Development	CFY	$ 7,940,000		
	PY	-0-		
			In-House	$ 4,071,000
	$	7,940,000	Contract	$ 3,869,000

d. Testing					
(1) Material Tests in Support of Joint Operational Plans/ and/or Service Requirements		$ -0-			
(2) Army Material Suitability Tests	CFY	$ 829,000			
	PY	-0-			
			In-House	$	829,000
		$ 829,000	Contract	$	-0-
TOTAL: Testing	CFY	$ 829,000			
	PY	-0-			
			In-House	$	829,000
		$ 829,000	Contract	$	-0-
TOTAL: DEFENSIVE EQUIPMENT PROGRAM	CFY	$ 83,031,000			
	PY	2,186,000			
			In-House	$	36,099,000
		$ 85,217,000	Contract	$	49,118,000
5. TRAINING SUPPORT					
a. Training	CFY	$ 190,000			
	PY	-0-			
			In-House	$	183,000
			Contract	$	7,000
b. Suitability Tests		$ -0-			
TOTAL: TRAINING SUPPORT	CFY	$ 190,000			
	PY	-0-			
			In-House	$	183,000
		$ 190,000	Contract	$	7,000

6. **SIMULANT TEST SUPPORT**	CFY	$ 1,447,000		
	PY	-0-		
			In-House $	957,000
TOTAL: SIMULANT TEST SUPPORT		$ 1,447,000	Contract $	490,000

EXPLANATION OF OBLIGATION

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences

This research provides a science base in support of:

(1) Chemical Defense Research. Program includes new concepts and the explanation of mechanisms related to decontamination and contamination avoidance, collective and individual protection, chemical detection, identification and alarms, material research, simulants and training systems.

(2) Chemical Retaliatory Research. Program includes a search for new classes of chemical agents. Investigations of chemical agent properties and reactions, and research related to chemical munitions.

During FY 83:

A theoretical study was initiated to evaluate the potential of Surface Enhanced Raman Spectroscopy for monitoring surfaces for the presence of organic chemicals.

A laser multiphoton ionization system was designed and equipment purchased and installed. The system will be used to study organophosphorus, organosulfur, and other classes of threat agents.

Air purification by heterogeneous catalysis is being studied under contract.

Naval Research Laboratory has improved charcoal performance, elucidated structural characteristics, and developed a method for measuring dust attrition of granular carbon adsorbents.

A new test procedure, employing specialized vibrational equipment has been developed and applied to a variety of granular carbon adsorbents.

Basic research in physical approaches to decontamination and contamination avoidance are to elucidate mechanisms and provide new concepts for exploitation.

Computer programs developed for flow visualization of liquid jet interactions with surface contamination were exercised.

Effort was also directed to characterize the extensional mechanical properties of polymeric fluids from measurements of shear. Preliminary results show promise of the practicality of such a technique.

Factors were identified for enhancing the effectiveness of high temperature/high velocity gas streams for surface decontamination, and information was transitioned to the exploratory development program.

Chemical approaches to decontamination work continued with microemulsions with sulfolane as a co-surfactant rather than alcohols.

Materials research work continues on the fundamental studies of decontaminant interactions with polymers. Experiments were performed with binary mixtures to see whether preferential solvation would occur. Work continued on a binary diffusion model.

Chemical detection, identification, and alarms work continued at Naval Research Laboratory. A new surface acoustic wave (SAW) microsensor has been designed, fabricated, and is being evaluated for response to organic vapors. A theoretical model has been developed and is being verified. Synthesis of a vinyl pyridine polymer is being developed for tests with chemical agent simulants on existing and/or new dual SAW devices.

Chemometrics research on simulants for chemical agents is being conducted. The objective is to formulate mathematical models relating the physical characteristics of a chemical compound to its structure for the purpose of finding new simulants for chemical agents which match the properties of target compounds as closely as possible.

Models have been developed to enable prediction of several of the physical properties deemed important in comparison of a simulant's action to the action of a CW agent. Using these models, it will be possible to select simulants better suited to a particular application.

Fluid dynamics studies have continued with a special canister in the projectile flight simulator for non-rigid payloads to measure internal wall pressure and shear stresses in the payload. Tests have been conducted with different homogeneous liquids under various experimental stresses.

A review of the gamma-aminobuteric acid neurotransmitter receptor was completed.

Refined monoclonal antibodies to the anticholinesterase agent Soman.

Refined Enzyme Linked Immunosorbent Assay (ELISA) for detection and identification of Soman.

Used the monoclonal antibodies against Soman in a homogeneous enzyme immunoassay "dipstick" detector.

Produced immunogens for laboratory development of monoclonal antibodies to the anticholinesterase agent GB and developed techniques to clone both somanase and butyryl cholinesterase for use in agent detectors and decontamination.

Continued development of the T-lymphocyte proliferation assay as an indicator of prior animal exposure to anticholinesterase nerve agents.

Clothing, Shelters and Other Material Systems

This program is to develop a technology base which permits the development of clothing, shelters, and other protective material systems that will minimize the effects of chemical/biological effects.

During FY83:

Subtilisin Carlsberg has been immobilized on cotton cloth by various methods. Kinetic measurements have demonstrated that the bound enzyme and soluble enzyme behave similarly with small substrate molecules, such as p-nitrophenylacetate. Trypsin has been immobilized on colloidal silica with a high recovery of activity, and high loading. Silica bound trypsin stoichiometrically binds bis(p-nitrophenyl)methylphosphonate with complete loss of activity. The bound enzyme could be partially reactivated by treatment with hydroxylamine at pH7, 25°C. The activity of these enzymes, when bound to cotton cloth, can be readily detected by treating the damp cloth with a chromogenic substrate which rapidly produces a color change. This agent may be exploited for agent detection.

The stability of and the effects of environment staphylococcal enterotoxin A (SEA) on glass or flexible foils used in Meal-Ready-to-Eat rations was studied and more rapid assay procedures were adopted.

Field observation was conducted on soldiers wearing CW protective masks to identify kinds of deficits to be expected from environmental restrictions. Environmentally controlled test room was designed and performance test battery was developed to measure deficits in the laboratory. Pilot studies with CW protective masks showed detrimental effects on vision, hearing, breathing, strength, manual dexterity, time estimation and feelings of claustrophobia.

Assessment was made of materials and protective systems to be studied and evaluated in regard to mycotoxin permeation.

Three categories for study were prioritzed as follows: fabrics, films, and elastomers as applied to CW protective uniforms, garments, gloves, and boots respectively.

New chemical compounds are being developed which can be attached to fabrics to detoxify agents.

Biosynthetic routes for the production of the three cyclodextrins (cyclic glucose oligomers containing six, seven and eight units) have been established. The catalytic effect of cyclodextrins in the decomposition of organophosphonates has been under investigation as an aid to contamination avoidance.

Samples of microbes reported to synthesize acetylcholinesterase, an enzyme to which nerve agents irreversibly bind, were obtained and grown on the chemical acetylcholine. A search was conducted for better microorganisms and three unidentified but different microbes were isolated from the soil and were found to grow several magnitudes faster on acetylcholine than any of the previously tested microbes. Comparative studies have been initiated to assess the ability of the newly isolated microbes to synthesize acetylcholinesterase.

Assessment was made and a best approach developed to elucidate the microscopic structure of carbon particles.

Scanning transmission electron microscopic (STEM) techniques were developed to enhance the elucidation of the microstructure of carbon particles and computer techniques were designed for performing image analysis of both light and STEM photomicrographs.

Medical Aspects of Chemical Defense: This program is to develop systems of antidotes, medical management of the chemical warfare casualty, and rapid decontamination for the Army, Navy and Air Force. The overall objective is to insure combat effectiveness, mission accomplishment, and soldier survivability in an environment where hostile forces employ conventional, chemical, and nuclear weapons.

Basic Research Objectives:

Establish a solid foundation for future chemical defense capabilities.

Define the mechanisms of the effects of agents in order to develop new and improved antidotes.

Define the mechanisms of the effects of antidotes to establish a basis for self-aid, and subsequent medical treatment of casualties.

The objectives of decontamination studies are to determine the mode of actions of chemical warfare agents and decontaminants on and in the skin and to acquire the knowledge required to perform effective decontaminaiton.

During FY 83:

Studied the basic actions of acetylcholinesterase activity; studied effects of certain chemical agents on the brain and their site of action is being identified.

Studied the immune response to chemical agents for development of a pretreatment regimen.

Tested air flow resistance in the lungs and upper airway of laboratory animals following exposure to chemical agents.

b. General Chemical Investigation: Exploratory Development

Chemistry and Effects of Threat Agents: The objective is to identify, synthesize, and study the chemical, physical, and toxicological properties and hazards of compounds posing a potential threat to the US chemical defense posture; to maintain an up-to-date technology in toxicology, chemometrics, chemical hazard analysis, and analytical, organic and physical chemistry in support of chemical defense investigations.

During FY 83:

Difficult synthesis of several possible threat agents was successfully completed and the most promising were subjected to toxicity screening.

Data bases were expanded, used for internal analyses, and shared with other DOD activities on the chemistry and effects of agents.

Sensitive analytical methods were developed and applied to a large number of foreign samples. Results are being furnished to the intelligence community and mission organizations.

Analysis and Integration of Chemical Defense Systems: The objectives of this program are: to develop the modeling and data base required to assess the foreign CB threat; to investigate and explain the processs controlling the operational performance of CB defensive and deterrent systems against the threat; to evaluate alternatives with regard to concept, design, and operational utility and provide the commander with the best possible basis for choosing a course of action; to develop new and improved methods and models to evaluate the effects of CB agents employed on the integrated battlefield.

During FY83:

A model describing the weathering of liquid agent on a moving vehicle was completed.

CB models, assessment methodology, and threat data were coordinated with Quadripartite Working Group (QWG), The Technical Cooperation Group (TTCP), various US Army Training and Doctrine Command (TRADOC) organizations, USAF, Navy, and numerous DoD contractors.

Incorporated models and participated in Chemical Battle Simulation (CHEMBATS) wargame.

Determined residual contact hazard for mustard agent on painted surfaces.

Completed studies on the efficacy of sorbent powders on contaminated individual protective equipment.

Completed a literature search on physiological response to chemical agents.

Toxin Defense Systems: The objectives of this program are to evolve new and improved concepts, methods, and materiel for providing defense for triservice applications against all potential threat toxins, and to apply biotechnology to detection of threat chemical and biological agents and toxins.

During FY83:

Completed preliminary testing of fielded CB Defense materiel with T-2 toxin and prepared report.

High pressure liquid chromatography and gas chromatography/mass spectrometry techniques were developed for the analysis of various trichothecene mycotoxins.

Hosted triservice coordination meeting on toxin defense. Completed review of biomicrosensor technology and prepared report. Planned biotechnology detection program.

Training Systems: The objectives are to provide simulant agents and disseminating devices to train both individuals and units to survive in a chemical or biological warfare environment through recognition of attack and execution of protection and decontamination procedures; to provide detection, decontamination, and protection equipment training aids; to provide simulant trialing agents for assessment of CBW defensive equipment and procedures. Materials will be developed to meet requirements for all services..

During FY83:

Demonstrated feasibility of M5 Disperser for aerial dissemination of thickened liquid simulant agent.

Developed a simulant agent to enable residual contamination disclosure after decontamination for use in Combined Arms in a Nuclear/Chemical Environment Force Development Test and Experimentation. *Field demonstrated concept feasibility of* XM11 SPAL/XM267 electric jack/plug connector in preparation for FY84 PIP. Provided technical advice to Chemical School, Program Manager for Training Devices, and to Jet Propulsion Laboratory for concept study of protective mask status monitor.

Furnished simulant agents and technical assistance to the High Technology Test Bed.

Chemical Protective Clothing and Equipment: The objectives of this program are to develop materials and concepts for chemical protective clothing and equipment that are capable of countering the threat of chemical agents while providing the essential mobility and comfort of a field uniform and to develop methods and/or systems for feeding troops in a CB contaminated environment.

During FY83:

Designed, fabricated, and field tested Overgarment 84.

Designed, fabricated, and field tested 1986 Chemical Protective Suit candidate materials.

Established heat stress, chemical protection, and durability of candidate overgarment materials.

Assessed the protective and physical properties of developmental materials.

Formulated diffusion and data base models and completed a logistical analysis.

Conducted agent testing on candidate materials and agent testing of uniforms after being wear tested.

Assessed modifications of flame retardant formulations.

Established new liquid/vapor surrogate test method.

Awarded contracts for:

a. The development of encapsulated carbon fabrics

b. The development of reactive/sorptive fabrics

c. The development of chemical reactive materials test methods

d. The investigation of active carbon solid fiber chemical agent reactivity

e. System/design fabrication services for experimental fabric and clothing systems for chemical protection

Natick Research and Development Center supplied technical support to other defense organizations by validating existing simulation methodologies and by simulating effects of toxic agent attacks on existing defense systems.

Contracts were initiated to expand the capabilities of computer-based chemical assessment methodologies to consider the effects of clothing and packaging.

A mathematical model was completed which estimates the agent concentration in field shelter systems.

Military rations (Meal, Ready to Eat) and other commissary items were selected and a contract was recently awarded to conduct chemical agent testing of the items.

A contract was also awarded to determine penetration of chemical agents into complete packaging systems. Tests were conducted using chemical agents at 40°C on simulated fiberboard closures as well as retort pouches.

Identified food packaging aspects requiring further studies to allow use of food items in an NBC environment, and conducted feasibility study on those areas where food protective packaging will be required. Designed and developed a prototype flexible nutrient feeding container which can be used for feeding troops wearing protective clothing. Conducted limited tests on the prototype feeding container to determine areas that required further development work. Conducted feasibility study on packaging of these prototype containers for containerizing, palletizing, shipment and storage.

A liquid NBC electrolyte beverage was developed that meets the parameters established by the Office of the Surgeon General. This liquid ration is packaged in a protected 12 oz pouch equipped with a plastic valve assembly that mates with the quick disconnect valve at the end of the M17A2 protective mask drinking tube.

A water soluble NBC electrolyte powder was also developed. One ounce of electrolyte powder is packaged in a small protected envelope. The contents of the envelope when poured into a canteen filled with water will make up to a quart of electrolyte beverage which can then be consumed by troops in protective clothing.

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development The objective is to provide the technology essential to development of deterrent systems. This technology includes chemistry, physics, toxicology, chemical and mechanical processing, and exploratory development of new munitions.

During FY83:

Numerous exploratory development activities on new chemical agents, munitions materials, and prototype weapons design were undertaken.

Studies were conducted on thickeners, stabilizers, and simulants for binary intermediate volatility agents (IVA).

Investigations were continued and/or were initiated to find new agents or methods of defeating protective ensembles and equipment.

Significant gains were made both in documenting increased reliability of the DF (intermediate for binary GB) filled M20 Canister for the M687 GB 155mm Projectile and determining promising additional materials to contain DF in future munitions.

Ecotoxicological tests were carried out on binary agents feedbacks/intermediates.

Investigations were implemented for new or improved binary submunitions applicable to the joint tactical missile system (JTACMS) chemical warhead.

Efforts continued towards solving generic chemical munitions problems including in-flight chemical leak detection, visco-elastic properties measurements, and air gun chamber tests for relating agents to simulants and basic projectile/warhead stability investigations with thickened liquids.

Chemical Agent Process Technology: The objective is to evolve processing concepts for riot control agents, lethal agents, and binary intermediates.

During FY83:

Investigations were conducted to evolve large scale chemical processing concepts for agents/intermediates in support of binary lethal agents, binary agents intermediate materials, and training agents. Seventeen different potential processes were studied for manufacturing one of the principal binary IVA intermediates and three processes selected for further investigation. Seven synthesis routes were explored for manufacturing a new potential training agent and narrowed to three processes for more detailed evaluation. The munitions mechanical filling and closure data base was expanded to provide munitions developers with a choice of closures and production base operations with better filling operational control.

b. Advanced Development

Tactical Weapons Systems:

During FY83:

The Advanced Development phase of a chemical warhead for the Multiple Launch Rocket System (MLRS) was suspended in Dec 82 as a result of elimination of FY83 funds by the Joint House-Senate Congressional Conference Committee. Preparation for initial flight tests of prototype simulant filled warheads was accomplished with residual FY82 funds.

A preliminary design concept for the XM450 Medium Altitude Proximity (MAP) fuze was prepared and demonstrated in a helicopter drop test. A prototype power supply and transmitter and two XM450 fuzes were fabricated for future flight testing.

The contractor fabricated three chemical warheads for flight testing.

Two successful flight tests of the XM448 fuze were conducted with the Zuni warhead.

The Advanced Development for XM877 Binary IVA 8 inch projectile was terminated. Developer tests were conducted using residual FY82 funds.

c. Engineering Development

Materiel Tests in Support of Joint Operational Plans and/or Service Requirements. Engineering support was continued to the US Navy in the development of the BLU-80/B BIGEYE bomb. Principal efforts consisted of conducting toxic agent and simulant chamber tests on the full scale instrumented bomb/reactor to ascertain the parameters of the binary agent reaction at various temperatures. Directly related to these chamber tests a highly specialized series of small scale laboratory tests were implemented to study the reaction product gases/vapors. The production-oriented fill and close interim technical data package was updated and toxicological testing was carried out on one of the binary agent chemical intermediates and its constituents. Wind tunnel confirmation of inherent bomb flight stability parameters was initiated in coordination with Navy and Air Force testing for off-station activation of the BIGEYE bomb.

d. Testing

Army Materiel Suitability Tests: Several series of tests were conducted at Dugway Proving Ground, UT, as part of the XM877 Binary IVA 8 inch projectile program termination.

3. INCAPACITATING CHEMICAL PROGRAM

a. Exploratory Development

Incapacitating Chemical Agents/Weapons: The objective is to discover and evaluate incapacitating chemicals, as well as munition devices for their delivery.

During FY83:

Investigations were conducted to evolve large scale chemical processing concepts for agents/intermediates in support of incapacitating agent materials.

A state-of-the-art review of potential incapacitating agents was completed and new classes of agents were selected for further study.

b. Advanced Development

No obligations were incurred.

c. Engineering Development

No obligations were incurred.

d. Testing

No obligations were incurred.

4. DEFENSIVE EQUIPMENT PROGRAM

a. Exploratory Development

(1) Physical Protection Investigations

Chemical and Biological Decontamination and Contamination Avoidance: The objective is to investigate procedures, designs, and materials which preclude chemical, biological and radiological contamination. Included are studies which support the development of methods of avoiding or minimizing contamination. Also to evolve materials and equipment for use in the decontamination of personnel items and organizational equipment by all armed services. Included are studies to allow for ease and speed of decontamination to the optimal degree practicable.

During FY83:

Testing and evaluation of the effects of decontaminants on materials of military interest were completed.

The "Design Guidelines Manual" was expanded to include additional vehicles and aircraft and is formatted to function (seats, hatches, etc.) rather than to the vehicle.

A decontamination effectiveness study was initiated to determine how effective fielded decontaminants (US and Allied) are in reducing agent contamination on the battlefield and to address data gaps to aid assessment of future efforts.

Agent tests to determine the factors controlling the transfer of agent from one surface to another were continued.

The contractual effort to comparatively evaluate state-of-the-art technology for development of a water-based decontaminant to replace DS2 and STB continued. Additional materials proposed as simulants were synthesized and testing of them for reactivity with standard decontaminants continued.

Studies were continued on the possible use of corona discharge to effect chemical and/or biological decontamination.

Investigations were initiated on the dispersing of substrates into coatings which would catalytically destroy chemical agents as they permeate into the film.

Robotic decontamination feasibility studies related to hardware development were initiated.

A systems analysis of concepts of a new Laundry/Bath Decontamination System was completed. A model which identifies critical steps in the Laundry/Decontamination process has been completed. The model will streamline the design, testing and evaluation of any present and future clothing decontamination system.

Individual Protection: The objective is to establish and maintain center of excellence in respiratory protection, including research, design, test and evaluation. To evolve new and improved concepts, methods and materials for individual protection against all potential threat agents for triservice application. To develop and maintain a technical base for the study of the protective mechanism of CB protective materials.

During FY83:

Contract effort, on alternate design concepts, has provided two prototype mask designs that will serve as a data base for Preplanned Product Improvement efforts related to the XM40 Mask, and provide candidate designs for an improved protective mask.

Development of a computerized data base was initiated to accommodate detailed information of agent, simulant and material interactions.

Systems analysis studies were started to evaluate the tradeoffs among protection from various battlefield hazards, comfort, and cost to indicate preferred CB protective clothing designs for specific environments.

An analysis of CB protective clothing design parameters to indicate a reduced logistic burden design goal was completed.

Experimental design, testing, and analysis of CB protective characteristics of individual equipment to insure personnel safety over extended periods and ranges of meteorological conditions was continued.

Procedures and equipment necessary to permit safe eating and drinking at fixed based facilities were defined. A mask compatible liquid supplement was shown to be technically feasible for sustenance of personnel wearing protective clothing.

Work was begun on a drycleaning laundry system with energy and water conservation characteristics and with the capability for CB decontamination. A test plan was developed to establish the capability of the present trailer mounted laundry to remove and destroy chemical agents from contaminated clothing.

Paint formulations were evaluated in accelerated and outdoor weathering exposures with follow-on incubations in tropical chambers. The susceptibility to fungal growth, the changes in visible and infrared reflectance characteristics, and the changes in susceptibility to chemical agents were determined before and after weathering and exposure to fungal attack. These studies continue.

Tests of fabrics used in the chemical protective overgarment were conducted in tropical chambers to assess susceptability to fungal attack. Nylon/cotton fabric blends were found to be susceptible to fungal deterioration, while the polyurethane impregnated foam was found to be less susceptible.

Fabric-impregnating formulations for chemical defense garments are composed of absorbents, dispersing agents, thickeners, binders, and flame retardants. Polyethylene oxide is used to diffuse the flame retardant into the fabric. Through the use of specific ion-exchange and polyether systems in combination with appropriate eluants, a method for separating and determining the presence of expected and reasonable amounts of polyethylene oxide was developed and tested on the individual components and the formulation mixtures.

Three prototype methods/devices for purifying CB contaminated water were screened and found to be acceptable for removing simulant CB contaminants: chemical "scaled down" erdalator method using dry chemicals in plastic bags; an activated carbon impregnated cellulose filter; and a commercially available portable compressed carbon cartridge with hand pump.

Collective Protection: The objectives are to establish and maintain a center of excellence in collective protection research, design, test and evaluation; to evolve new and improved concepts, methods and materials for collective protection research, design, test and evaluation; to evolve new and improved concepts, methods and materials for collective protection against all potential threat agents for triservice application; to develop and maintain a technical base for the study of triservice application; to develop and maintain a technical base for the study of the mechanism of CB protective materials.

During FY83:

Initiated percutaneous protection efforts.

Initiated study on corona discharge for detoxification for collective protection systems.

Published final report on filter residual life indicators.

Completed entry/exit testing to establish design criteria data base.

Initiated an advanced air purification concept based upon high pressure adsorption/low pressure desorption to achieve improvement in air filtration design.

Work to harden tentage against the chemical warfare threat was emphasized, including work to harden the TEMPER tent, and development of concepts for new General Purpose hardened tents.

Exploration of structural alternatives continued, including lightweight frame and high pressure airbeam structures. Testing was completed on heat loss and gain characteristics of various tent design alternatives; similar effort was initiated on tentage ventilation.

(2) Warning and Detection Investigations

Reconnaissance, Detection and Identification: The objectives are to evolve new and improved concepts for reconnaissance, detection, warning, and identification of all threat and new chemical, toxin, and biological agents for all military and industrial operations; to develop battlefield contamination display and NBC sensor intelligence interface systems; to increase sensitivity, specificity, and ease of use; to decrease logistics burden; and to minimize the number of detectors in the field. Applicable to Air Force, Navy, Marine and Army requirements.

During FY83:

Studies were initiated on contamination monitoring to determine the rate of evolution of agent vapors from contaminated surfaces and the fate of chemical agents in the environment. Investigations were begun for a dosimeter or individual detector.

An initial analysis of the hazard for NBC reconnaissance was completed. Models were completed for marking and detection using the door of the reconnaissance vehicle. Surveys were conducted of command, control, communication intelligence for NBC reconnaissance. A tandem mass spectroscope was tested and found capable of detecting threat agents. Studies on use of point sampling detectors for aerial reconnaissance were initiated.

Surface reflectance measurements using infrared laser systems were completed. Spectral data on all the threat agents are being obtained and compiled into a library.

(3) Medical Defense Against Chemical Agents

The objectives are to develop antidote, pretreatment, prophylactic, and therapeutic drugs for safe and efficacious prevention and treatment of the effects of chemical agents and ionizing radiation; to develop a system that will enable us to determine both the level of decontamination required to provide support and a concept of decontamination that maximizes safety and survivability; to develop criteria for threshold limits of performance/physiological burden to be imposed by decontamination; to develop criteria for triaging battlefield casualties that identify the probability of survival; to develop criteria for making decisions to evacuate a CW casualty to a clean environment for treatment or to treat in a contaminated environment; to develop a total

system of medical management (triage, diagnosis, resuscitation, treatment, life support management, and evacuation), in a CW environment; and to develop and assess new approaches and design characteristics for application to military medical materiel.

During FY83:

Evaluated human performance decrements at various doses of treatment compounds.

Tested potential personal decontaminants and protectants.

Studied chemical hardening procedures for field medical equipment.

Redesigned individual resuscitation device.

Evaluated ambulatory chemical agent protective patient wrap. Studied recovery times for pretreatment compounds.

Studied a laboratory whole cell test system for use as a vesicant research model.

Tested current antidotes for their effects on the cardiovascular system and body temperature control.

b. Advanced Development

(1) Chemical Decontaminating Material

Decontaminating Apparatus, Portable, M13: The decontaminating apparatus, portable, 14 liter, M13, has been designed to dispense standard chemical agent decontamination solution (DS2). The M13 is man portable, manually operated, easily maintained, and mounts on the equipment on which it is used. Operators of the equipment use the M13 to decontaminate those areas of the equipment which are needed for normal operations and maintenance.

Operational Test IA was conducted and a Development Acceptance In-Process Review (DEVA IPR) was held resulting in a recommendation for type classification standard with Follow-on-Evaluation. A production contract was awarded.

Decontaminating Apparatus, Portable: Interior Surface, XM15: The Interior Surface Decontamination System (ISDS) is being developed to provide the Army with the capability to decontaminate chemical and biological (CB) warfare agents on the interior surfaces of

vehicles, vans, shelters, aircraft, and watercraft. The ISDS will be small, carried onboard and used by the crew.

Development Test I was conducted and showed a need for a minor redesign to make the unit more rugged. Work on a draft Required Operating Capability document was begun.

Decontaminating Apparatus, Truck Mounted, Jet Exhaust, XM16: The XM16 Jet Exhaust Decontaminating Apparatus consists of a J60-P-6 Jet Engine mounted on a hydraulic turntable. Beside the jet engine, there is a control cab from which the system operator can direct the jet engine's hot exhaust gases over the surfaces of a contaminated vehicle. An injection nozzle is located at the engine's exhaust for injecting water or smoke-producing liquids.

Development Testing (DTI) and Operational Testing (OTI) were completed in FY83 and test reports were published.

A draft requirements document (DROC) was prepared and a Cost Operational Effectiveness Analysis (COEA) was started.

(2) Collective Protection Equipment

Collective Protection Equipment: NBC Simplified, XM20: This project is to develop low-cost, easily transportable equipment for converting a room of an existing building into a positive pressure collective protection chemical-biological shelter for ten men. The XM20 Simplified Collective Protection Equipment (SCPE) will be used for rest, relief, command, control, and communication.

Engineering Design Tests were completed, and necessary equipment modifications were incorporated into the design.

Development Test (DT) hardware was fabricated and testing was completed.

(3) Chemical Detection and Warning Material

Automatic Liquid Agent Detector (ALAD): The objective of this program is to perform the advanced development of an automatic liquid chemical agent detector capable of detecting a single 200 micrometer diameter droplet of liquid agent and capable of operating in two distinct modes: (1) stand-alone in which each individual detector can provide a local

alarm, and (2) network in which a number of detectors (2 to 15) are monitored by a single central alarm unit. Development and operational tests (DT/OT I) were successfully completed.

Remote Sensing Chemical Agent Alarm, XM21: This alarm is being developed to remotely detect nerve agent vapor clouds at nominal ranges of 3 to 5 km. A prototype full-up detector, which includes an azimuth scanner, Michelson interferometer, cryogenically cooled infrared detector, and microcomputer has been completed and agent detection has been verified in chamber tests. Field testing has demonstrated detection of nerve agent simulants without false alarm to battlefield smokes and interferences.

Automatic Chemical Agent Alarm, XM22: The objective is to develop a multi-agent alarm with the capability to serve as a point sampling alarm, as a monitor inside collective protected shelters, and as a surface monitor to detect contaminated surfaces and determine the effectiveness of decontamination. Preliminary design efforts were completed and fabrication of study models was initiated. Nuclear hardening tests were conducted on piece parts to verify design acceptability. Program reviews and Test Integrated Working Group meetings were held with Tri-Service representatives.

Water Testing Kit, Chemical Agent M272: The objective of this project is to develop a modern capability for testing water for chemical agent contamination. The M272 will be used for reconnaissance of water points and to verify that contaminated water which has been treated is suitable for consumption. Environmental testing was completed. A DEVA IPR was held and it was agreed to type classify the M272 out of advanced development. The M272 was formally adopted on 28 Jan 83.

(4) Medical Defense Against Chemical Warfare

The objectives for the advanced development are to establish kinetic relationships that will permit formulation of pretreatment and therapeutic drugs with a maximum stability and efficacy and a minimum of side effects to support a new drug application (NDA) with the FDA; to seek advanced development of chemotherapeutics and medical concepts that will prevent or minimize injury due to CW agents; and to determine equipment/systems technical feasibility, operational effectiveness, military utility, and ultimate cost.

Significant advanced development accomplishments in FY83 include: Developed chemical agent protective wrap (whole body); evaluated patient wrap heat stress and carbon dioxide buildup studies; contracts for the development of individual

medical monitoring equipment were awarded; specifications for the fabrication of chemically hardened field medical equipment were processed; developed protocol for human pharmacokinetic studies of present treatment compound; studied clinical tolerance of the blood agent antidotes; studied the stability of the second generation treatment compound formulations for nerve agent poisoning.

(3) Medical Chemical Defense Life Support Material

Nonsystem Advanced Development: This program element supports the nonsystem advanced development effort to meet the needs of the US Armed Forces for Military Medical Drugs to improve the survivability of the soldier on the integrated battlefield. The objectives for the nonsystem advanced development are: advanced nonsystem chemical and radiation antidote development; development of industrial manufacturing base for production lots of pharmaceutical grade compounds having potential as chemical agent pretreatments, therapeutics, prophylaxis, and antiradiation drugs; and generation of data to support a notice of application for an investigational new drug (IND).

During FY 83:

Large quantities of organophosphate antidotes for biological study were prepared; analytical methods to evaluate preclinical candidates as organophosphate antidotes were conducted; two IND antiradiation drugs were produced; initiated preclinical studies on several antiradiation drugs; initiated efficacy studies on a cyanide pretreatment compound; studied the effects of the current chemical agent treatment on the visual system; applied for IND for nerve agent pretreatment compound and reformulated nerve agent antidote.

c. Engineering Development

(1) Decontamination Concepts and Material

Decontamination Apparatus, Power Driven, Lightweight: XM17: The Lightweight Decontamination System (LDS) will be used for equipment decontamination operations and patient decontamination at medical treatment facilities. The LDS will have three components (lightweight decontamination apparatus, accessory pack, and collapsible self-supporting water tank) of which no component shall be larger than 21 cubic feet or weigh more than 350 pounds. The LDS will provide water at controlled pressures and temperatures. It will require only water and fuel for operation.

The New Equipment Training was completed. The unit was exposed to climatic tests and functional tests to assure the design requirements have been met.

Decontamination Apparatus, Diesel Powered Skid Mounted, XM18: This will replace the M12A1 Power Driven Decontaminating Apparatus (PDDA) in heavy divisions. It will consist of three main components: (1) a 500-gallon stainless steel storage/mixing tank, (2) main pump unit, and (3) hybrid Steam/High Pressure-Hot Water Heater Unit. Accessory components consist of: a combat vehicle rinse rack, universal fire hydrant adapter kit, terrain decontaminant spray bar, personnel shower, and additional lengths of discharge hose. The apparatus will be capable of mixing and dispensing decontaminants, water, and water based cleaning solutions.

The XM18 prototype design and fabrication continued. Partially assembled skid bases of the pump unit and steam cleaner/heater demonstrated that basic system requirements can be met. The Coordinated Test Program (CTP) was outlined by Test Integration Working Group (TIWG) members and test criteria were established for development and operational testing (DT II/OT II).

(2) Collective Protective Systems

Modular Collective Protection System (MCPE): The MCPE provides chemical and biological (CB) protection against known CB threats for vehicles, vans, and shelters through the use of standard items of supply. An additional 34 van and shelter systems were identified as requiring CB protection, bringing the total to approximately 93. The objective is to provide kits for chemical warfare protection for the Army Standard Family of Rigid Wall Shelters. These shelter systems will provide a "shirt sleeve" environment to allow the assigned mission to be performed in a chemical warfare environment. A 4 ft X 8 ft interior space is used to house the equipment and provide room for a self contained protective entry. Also, under development are complexing kits which allow shelters to be complexed folding-side to folding side, fixed-side to fixed-side or fixed-end to fixed-end.

During FY 83:

Design, fabrication, and functional testing of a prototype Chemical Protection (CP) Rigid Wall Shelter was completed.

Design and fabrication of a CP One-sided Expandable Rigid Wall Shelter is in progress.

Prototype design and fabrication of complexing kits has been completed. The protype complexing kits were shipped to the test site.

(3) Warning and Detection Equipment

Simulator Dectection Unit, Chemical Agent, Automatic Alarm, XM81: The XM81 is a training device for use with M43/M43A1 Detector units of the M8 Automatic Chemical Agent Alarm. The device will be capable of being selectively activated to simulate agent cloud travel during field training exercises. The XM81 will use normal field operational procedures associated with the M8 Alarm system.

Development Tests (DT II) were satisfactorily completed and Operational Tests (OT II) were conducted.

Simulator Detector Tickets, Chemical Agent: Training, M256 (TRAINS): The M256 Kit has been engineered to give controlled positive or negative tests, giving users training in operation and in interpretation of results. The M256 Kit will contain an assortment of 36 samplers to simulate positive nerve, mustard, phosgene oxime, and blood agent tests.

The operational Test II Independent Evaluation Report was completed. A DEVA IPR was held and the item was accepted into Army inventory.

Chemical Agent Monitor (CAM): The objective is to conduct an International Materiel Evaluation (IME) of the UK developed CAM to achieve fielding of a contamination monitor. The monitor will detect, locate, and identify chemical agent vapor contamination emanating from equipment, personnel and surfaces. The CAM detection is based on ion mobility spectrometry. Microprocessor techniques are used to detect, identify, and indicate the relative amount of contamination and reject interferences.

Several coordination meetings were held in the US and UK during FY83 to define UK testing acceptable to the US and to define the tests to be conducted in US. UK Army user trials were conducted in Germany and data collected will be provided to the US to minimize US Operational Testing.

(4) Individual Protection Equipment

Mask, Chemical-Biological, Multipurpose, XM40: The XM40 protective mask will provide protection for the face, eyes, and respiratory tract against field concentrations of all

chemical and biological agents in vapor or aerosol form, toxins and radioactive fallout particles. The mask, with appropriate components, shall replace the M17A2 field, M24 aviation, M25A1 tanker and M9A1 special purpose masks.

During FY83:

Three design contracts (phase I) for Prototype XM40 Masks were awarded. A Design Qualification Test (DQT) of the Phase I prototypes was conducted at seven Army test agencies to evaluate competing XM40 mask prototypes and the British S-10 respirator, and a review of the Phase I effort and DQT was conducted.

d. Testing

(1) Material Test in Support of Joint Operational Plans and/or Service Requirements

No obligations were incurred.

(2) Army Material Suitability Tests

Modular Collective Protection Equipment: Development Test II of the Static Frequency Converter (SFC) was conducted at the TECOM Tropic Test Center. The objective of the test program was to measure the degree to which the SFC and its maintenance package conform to the requirements of the system specification for CB Collective Protection for vans and shelters under tropic climatic conditions.

Decontaminating Apparatus, Power Driven, Lightweight: XM17: Testing during the report period consisted of IME tests at all climatic test sites, White Sands Missile Range and Dugway Proving Ground.

Collective Protection Equipment NBC, Simplified, XM20: Development Testing was completed at the Tropic Test Center, Cold Region Test Center, Desert Test Center and White Sands Missile Range.

Automatic Liquid Agent Detector (ALAD): Development and Operational Tests were successfully completed.

5. Training Support

a. Training

Simulator, Projectile, Airburst, Liquid XM11 (SPAL): The SPAL is a training airburst device designed to simulate an artillery chemical agent attack. The SPAL is launched from the liquid airburst projectile launcher. Disseminated droplets are detected on paper on the soldier's outer garment. Type classification was completed.

6. SIMULANT TEST SUPPORT

Efforts were directed toward the planning, conducting and/or reporting on joint tests and/or operational research studies in response to requirements received from the Commander-in-Chief of the Unified and Specified Commands and Services. Tests and studies provide essential data on chemical systems and chemical/biological defense material to meet user requirements. During this report period the following were performed:

Chemical Logistics Evaluation: This test was designed to evaluate the current US Marine Corps Chemical Weapons and Support System. Testing consisted of six subtests covering all aspects of the stockpile-to-target sequence. Test was completed and reports covering all aspects of the program were published and distributed.

Materiel/Terrain Decontaminant Evaluation: This test is designed to evaluate decontamination effectiveness on a variety of military equipment surfaces, including aircraft. Testing consisted of six subtests, which covered different combinations of agent/decontaminants/materials/temperatures. To date, four of the six subtests have been completed.

Aircraft Operations - Toxic Environment: This test is designed to evaluate the hazards associated with aircraft operations under both ground and flight conditions while in a toxic environment and to evaluate standard and non-standard techniques for decontamination. Testing continued utilizing a variety of multi-engine aircraft, helicopters, and fighter aircraft. To date 127 trials of 233 trials have been conducted.

Mission Degradation Associated with Chemical Protection: This test is designed to evaluate the combat degradation of US troops when performing a variety of soldier

functions while wearing protective clothing. During this report period, a test plan was written, coordinated and published.

Assessment of Toxic Environment: This study is designed to define the potential toxic environment produced by chemical weapon systems under various meteorological conditions. The study is continuing and a report will be published.

Effects of Decontaminants on Air Defense Equipment: This study was designed to evaluate the effects of decontaminants on air defense equipment, identify knowledge gaps and make recommendations for testing requirements if warranted. Study was completed and a report published.

Effectiveness of Missiles Against Ships: This study was designed to evaluate the effectiveness of chemical weapon systems against Naval Forces when subjected to an attack. Study was completed.

Maintenance Operation in a Chemically Contaminated Environment: This test is designed to evaluate the effects of a chemical attack on representative types of maintenance operations. Performance degradation for maintenance battalion and ordnance units using baseline and protective postures will be determined. Test plan was completed.

Medical Battalion Support During Amphibious Operations in a Toxic Environment: This study is designed to evaluate a Marine Corps Medical Battalion in support of a Marine Assault Brigade (MAB)/Marine Assault Unit (MAU) during amphibious operations in a toxic environment. Study was initiated. Literature search and document review were begun.

Amphibious Operations - Toxic Environment: This test is designed to evaluate Navy/Marine Corps amphibious operations in a toxic environment. Draft test plan was completed.

Chemical Defense Operation in Extreme Cold: This study is designed to evaluate chemical defense operations in extreme cold. Literature search was initiated.

Simulant Review and Selection: This project is a continuing effort and is designed to develop a spectrum of test materials which may be used to simulate agent behavior for use in field testing. During this report period major emphasis was on the development of sampling and assaying methods and a report evaluating contamination effects as a function of single drop characteristics, their relationship to contamination density, and the development of a methodology for use of single-drop effects. A report titled "The Use of Solid Sorbent Tubes as Vapor Samplers" was published.

DESCRIPTION OF PAA EFFORT FOR THE EFFORT FOR THE CHEMICAL WARFARE PROGRAM

There were no obligations during FY83 for procurement of chemical weapons systems and production base projects.

Breakdown of Program Areas

1. LETHAL CHEMICAL PROGRAM		
a. Item Procurements	$	-0-
b. Production Base Projects	$	-0-
2. INCAPACITATING CHEMICAL PROGRAM		
a. Item Procurements	$	-0-
b. Production Base Projects	$	-0-

SECTION II

OBLIGATION REPORT ON BIOLOGICAL DEFENSE RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMEBER 1983

DEPARTMENT OF THE ARMY

RCS: DD-DR&E (SA) 1065

DESCRIPTION OF RDTE EFFORT FOR THE BIOLOGICAL DEFENSE RESEARCH PROGRAM

During FY83, the Department of the Army obligated $37,705,000 for biological defense research investigation and the development and test of physical and medical defensive systems.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$ 22,289,000		
Prior Year (PY)	$ 15,416,000		
		In-House	$15,080,000
TOTAL	$ 37,705,000	Contract	$22,625,000

Breakdown of Program Areas

1. Biological Defense Research

a. Basic Research in Life Sciences	CFY	$ 1,002,000		
	PY	$ -0-		
			In-House	$ 656,000
	$ 1,002,000		Contract	$ 346,000
b. Defense Research Sciences	CFY	$ 6,406,000		
	PY	$ 6,520,000		
			In-House	$ 4,610,000
	$ 12,926,000		Contract	$ 8,316,000
TOTAL: BIOLOGICAL DEFENSE RESEARCH	CFY	$ 7,408,000		
	PY	$ 6,520,000		
			In-House	$ 5,266,000
	$ 13,938,000		Contract	$ 8,662,000

2. DEFENSE SYSTEMS

a. Exploratory Development	CFY	$ 11,400,000		
	PY	8,896,000		
		$ 20,296,000	In-House	$ 8,913,000
			Contract	$11,383,000
b. Advanced Development	CFY	$ 2,931,000		
	PY	-0-		
		$ 2,931,000	In-House	$ 742,000
			Contract	$ 2,189,000
c. Engineering Development	CFY	$ 550,000		
	PY	-0-		
		$ 550,000	In-House	$ 159,000
			Contract	$ 391,000
d. Testing		$ -0-		
TOTAL: DEFENSIVE SYSTEMS	CFY	$ 14,881,000		
	PY	8,896,000		
		$ 23,777,000	In-House	$ 9,814,000
			Contract	$ 13,963,000

3. SIMULANT TEST SUPPORT $ -0-

4. MANAGEMENT AND SUPPORT $ -0-

1. BIOLOGICAL RESEARCH

a. Basic Research in Life Sciences

The objectives of this task are to provide research to support the Biological Defense program and to maintain a technology base for non-medical aspects of biological defense. Research is conducted tro select and appraise the potential of new concepts for rapid detection, identification, and decontamination of biological threat agents in the field. Potential threats to present and future materiel and systems are also considered.

During FY83

Developed an immune serum against the mycotoxin T-2 for use in rapid detection immunoassay systems.

Study of virus specific detection methods using antigen-antibody type reactions continued.

A program was initiated to investigate electrochemical reactions (i.e., polarography) for biological material interaction.

An investigation of biological spectral interactions including microwaves was continued to establish a basic data base for development of real time approaches to remote or point detection.

Study of infrared absorption for the detection of biological agents was continued. Realistic field data is being generated using simulant aersols.

Investigation of rapid biological aerosol detection bvased on ultraviolet fluorescence was continued.

Investigation of single particle mass spectroscopy for biological detection was continued. Results have been obtained using several biological materials.

b. Defense Research Sciences

This scientific area is being developed, programmed and executed to provide and maintain the science base information necessary for the development of new and improved systems for the medical diagnosis, treatment and prevention of biological warfare (BW) casualties in order to meet the unique needs of the soldier fighting on a BW battlefield.

The basic research objectives in this area are: To characterize and determine the physio-chemical nature of militarily important bacterial toxins, how these toxins enter the cell, how they cause cell destruction and initial strategies on how safe and effective treatments and preventative measures can be devised. To develop an essential scientific base of information to counteract, medically, the threats posed by newly emerging or recently discovered bacteria and reckettsia. To evaluate newly discovered groups of extremely dangerous viruses for their potential threat to US forces, either as BW agents or as natural threats in certain geographic areas. These highly lethal but poorly understood viruses must each be studied under laboratory conditions which permit the maintenance, at all times, of rigorous containment techniques to protect "at risk" workers and the surrounding community. The Russian-supported use of deadly trichothecene toxins in Indochina led to a new and comprehensive research program concerned with the medical defense against small molecular weight toxins such as T-2 and other mycotoxins as well as marine toxins.

During FY83:

The anthrax accident at Sverdlovsk in 1979 provided highly presumptive evidence that the Russians have weaponized and stockpiled this organism. It therefore follows that a prudent course for the United States to follow is to develop an effective medical defense against anthrax. A solid base of information on the nature of the anthrax toxins, edema factor (EF) and lethal factor (LF) and their common carrier, protective antigen (PA), and how they interact to contribute to virulence of the disease has been established.

Genetic and DNA recombinant technologies are being studied to increase production of PA. Conventional methods are tedious and yield small, almost minimal quantities of each toxin for adequate investigation. Thus far, yields have been improved about six-fold for each toxin. Most importantly, the gene for PA has been incorporated into the microorganism, E. coli. With a few minor refinements in technique, it should be possible to produce large quantities of highly specific PA for use as a vaccine or as a key antigen fraction in a multicomponent vaccine.

Highly sensitive and specific ELISA tests were developed that can detect as little as 0.1 ng of PA, 0.5 ng of LF, and 0.5 ng of EF. These assays are important to the diagnosis of anthrax and the identification of the bacterium.

Methods were developed for successfully isolating the spore coat protein of Bacillus anthracis, vollum 1B strain. Experiments are underway testing it as a potential protective immunogen in guinea pigs.

In addition, methodology has been developed to identify mutants of Bacillus anthracis which produce very high levels of protective antigen, or lethal factor or edema factor. In another area, batch purification of plasmid DNA from vollum 1B large-volume (5 liters) was accomplished using vertical rotor isopyknic ultracentrifugation. The time of purification was reduced from 48 to 15 hours with the new procedure.

The live, attenuated Chikungunya Vaccine which showed so much promise in the FY82 report, failed to materialize. The master seed stock became too attenuated and failed to elicit an immune response in experimental animals. New seed stocks with better characteristics are under study; however, a new vaccine will not be ready for testing until FY 1985.

Since the last report, 93 antiviral candidate drugs have been screened in vitro and 67 drugs in vivo. One of the most promising approaches is described as follows. Muramyl dipeptide lipophylic derivative was encapsulated in liposomes or was attached to liposomes by mixing. This mixture was used to treat mice infected with Rift Valley Virus. The drug, when delivered via lysosomes, provided most promising results: (a) protection was elicited by macrophage activation and not by antibody response; (b) one administration of the drug protected mice for 3-4 days; (c) the drug is nontoxic and thus can be used on a frequent basis.

The P4 isolation suite received its first patient since the facility was upgraded to P4 biohazard containment. The patient, who was potentially exposed to Junin Virus, did not develop Argentine Hemorrhagic Fever(AHD) and was discharged 22 days following the accident. Health care was delivered wearing the chemturion, one-piece positive pressure suits. Several revisions in procedures were made as a result of this experience.

Joint training exercises using the vickers transportable isolator and patient care systems have been established with the 60th AAS, Andrews Air Force Base on a bimonthly basis.

A research program was designed and established in Kenya which resulted in discovery of the enzotic maintenance cycle of Rift Valley Fever Virus (RVFV). Infected larvae of Aedes lineatopennis survive the dry season in land depressions. When the rains occur, mosquitoes emerge which are infected with RVFV and are fully capable of transmitting the virus.

Fundamental studies on Legionella pneumophilia have been completed.

Argentine, Ebola and Korean Hemorrhagic Fevers are viral diseases causing considerable human morbidity and mortality in Argentina, the Far East, and Africa, respectively. The threat potential for allied armed forces deployed within these regions is considerable. There currently exist no vaccines for prevention of these diseases. Available therapy is impractical, untested, and therefore, ineffective. Moreover the demonstrated stability of these viruses under adverse environmental conditions make them attractive as candidate BW weapons for use by an enemy, and underscores the necessity of effective prophylaxis. In order to develop preventative and therapeutic strategies, it is necessary to devise animal model systems which mimic as closely as possible the clinical illness seen in man. Infections of Rhesus monkeys with Junin Virus (causative agent of AHF) have been achieved. Disease closely mimics human AHF: clinical, biochemical, and virologic changes are analogous to those seen in humans, and appear to be virus strain related. The Rhesus monkey also appears to be a reasonable model for the study of Ebola Virus. Unfortunately, effort to develop an animal model for Korean Hemorrhagic Fever (KHF) has not been successful; however, efforts to define a model for KHF are continuing.

Trichothecene toxins, and T-2 Mycotoxin in particular, have been implicated as chemical agents being used in southeast Asia and Afghanistan. Once victims of yellow rain develp symptoms of toxicosis, there are no specific therapeutic measures that are effective. However, if the toxin is rapidly removed from the skin following exposure, by washing with soap and water, toxicosis is either prevented or greatly ameliorated, as discovered in animal models.

A guinea pig synaptosomal system was developed for studying the effects of botulinum toxin. This new system was used to replace the unpredictable nature of nerve cell cultures. This new system has shown that both type A and type B toxins inhibit high-affinity choline uptake.

Hybridomas were developed using density-gradient-purified Coxiella burnetii for both Phase I and Phase II organisms. This represents a first step toward the development of monoclonal antibodies to specific, key antigens and eventually, a new generation of vaccines for this militarily important disease (Q fever).

The cell adapted strain of Hantaan Virus has been biophysically and biochemically characterized. This information has led to classifying the virus as the prototype species of a new genus of the family Bunyaviridae. The virus was concentrated by rate zonal ultracentrifugation through sucrose gradients. A single sedimentary peak of infectivity was observed by plaque assay of individual gradient fractions. Solid-phase radioimmunoassay (RIA) of each of the gradient fractions demonstrated that a single peak of virus antigen corresponded to the infectious virus.

2. DEFENSIVE SYSTEMS

a. Exploratory Development

Physical Defense Against Chemical Agents. The objective is to evolve new and improved concepts for reconnaissance, detection, warning, and identification of all threat and new biological agents for all military and industrial operations; to develop battlefield contamination display and NBC sensor intelligence interface systems; to increase sensitivity, specificity, and ease of use; to decrease logistics burden; and to minimize the number of detectors in the field. This work is applicable to Air Force, Navy, Marine and Army requirements.

During FY83

A prototype biological agent test kit for bacterial and virus was fabricated. Pathogen testing confirmed the bacteria test. Approaches to develop a toxin test have been initiated. A cooperative program has been established with the US Army Medical Research Institute for Infectious Diseases (USAMRIID) for pathogen testing of the biological agent test kit (BATEK). The bacterial portion of BATEK will enter advanced development in FY84. Virus identification will be added as a preplanned product improvement.

Military Disease Hazard Technology: This program supports the development of vaccines, toxoids, and drugs needed to prevent defeat of the US armed forces in a nonconventional confrontation with hostile forces.

The objective of this area are: The aerosol assessment of microbiological organisms or their toxins to assess their danger as biological warfare (BW) threats. The development of safe and effective vaccines/toxoids for those agents and toxins which are significant BW threats. The development of effective antiviral drugs. The technology necessary to identify a BW agent within 6 hours or the ability to diagnose a disease rapidly and reliably; that is before classic disease symptoms become manifest. The assesssment and evaluation of viral agents and their vectors that pose a potential BW threat.

During FY83:

Aerosol and pathogenesis studies of Junin Virus, the causative agent of Argentine Hemorrhagic Fever(AHV), were completed and indicated that Junin virus is highly infectious as a small particle aerosol. One respiratory LD_{50} in outbread guinea pigs is 2.8 plaque

forming units. Junin Virus has an affinity for lung and upper respiratory tract tissue. Virus concentrations in these tissues are 30 times greater than in the blood.

The development of a safe and effective live, attenuated vaccine for AHV continues on schedule. The Junin candidate No 1 seed has passed all FDA-required tests including the critical neurovirulence test in Rhesus monkeys. No primates which received secondary seed or vaccine exhibited signs of CNS involvement.

Studies are continuing on Mozambique Virus, an attenuated virus which cross reacts with Lassa Fever. The development of a live, attenuated Mozambique Vaccine which would protect against Lassa Fever would constitute a significant milestone. In another key study, cross protection of lymphocytic chorimeningitis (LCM) and Lassa Fever viruses was confirmed in monkeys. Cross-protection depends upon something other than neutralization antibody. This information offers some hope of a vaccine being derived from LCM Virus which protects against Lassa Fever.

Four gene clones, representing 80% of the entire M segment of the benome of RVFV, have been produced and are being sequenced.

An extramural contract has produced 2,000 doses of botulism immune human globulin (ABCDE). The product is 99% pure human globulin extract(I_gG), nonpyogenic, sterile and does not induce platelet aggregation, thus reducing the possibility of adverse reactions. A second contract involves the production of a hepatavalent (ABCDEFG) equine antitoxin. The optimum method for despeciation is treatment with 3% pepsin at 45° and pH 4 for 60 minutes. This procedure converts almost all of the intact equine I_gG to F $(ab)_2$ fragments.

Studies are underway to produce monoclonal antibodies to botulism toxins A, B, C, D, and E. In another botulism study, 3, 4, diaminopyridine, an agent which increases calcium influx, was found to be more effective in reversing muscle paralysis in type A than in type B botulinum toxin exposures.

Mechanical transmission of RVFV was shown to be possible by many different species of blood feeding arthropods. This discovery might explain, in part, the epizootic nature of the virus.

Antibody to Hantaan Virus, causative agent of Korean Hemorrphagic Fever was found by immunofluorescent antibody (IFA) assay in sera of humans and/or rodents sampled in Thailand, Burma, the Phillippines and Argentina.

ELISA methods were developed that can detect Type E botulinum toxin. Moreover, ELISA methods were developed that can detect protective antigen of Bacillus anthracis in the 1-3 nanogram level.

b. Advanced Development

Drug and Vaccine Development: This program element supports the advanced developmental effort of military medical vacine and drug needs to prevent defeat of the US armed forces in a nonconventional confrontation with hostile forces.

Objectives:

To scale-up laboratory processes for vaccine preparation into pilot and industrial-scale operations.

To prepare pilot quantities of specified vaccines for expanded testing and for administration to "at risk" workers.

To prepare and store moderate stocks of specified vaccines which could be used in emergencies.

To document vaccine scale-up from laboratory to industrial scale with good descriptive reports such as standard operating procedures, definition of equipment requirements and material balance data. In an emergency, any pharmaceutical manufacturer could use these reports to produce large quantities of the vaccine.

To establish industrial base operations for rapid identification and diagnosis of BW threat agents.

To establish industrial base operations for therapeutic and prophylactic regimens for man against natural infections of unique military importance and against those agents considered to have a significant BW potential.

During FY83:

Live-attenuated Junin Vaccine was produced and safety tested.

Live-attenuated Dengue-1 Vaccines (45AZ5 and TP 79-56) were produced, safety tested and IND applications prepared for submission.

Lymphocyte Hybridoma and monoclone antibody programs were instituted.

Antiviral drug development program was expanded to allow screening of a larger number of compounds against a broader spectrum of hazardous viruses.

Reference inactivated antigens were produced to support rapid virus diagnosis program.

Reference stocks of Korean Hemorrhagic Fever Virus prototype strain were prepared, tested and placed in American type culture collection for distribution.

Korean Hemorrhagic Fever and Rift Valley Fever diagnostic reagents were produced, safety tested and distributed.

Storage stability tests were conducted on Tularemia Vaccine.

Lots of MRC-5 and BSC-1 cells were prepared and tested to certify for use in vaccine development and production.

Phase-2 human-use trials were successfully completed for inactivated tick-borne encephalitis vaccine.

c. **Engineering Development**

Biological Defense Material Concepts: The objective is to complete engineering development of a first generation biological detector and warning system, XM19/XM2, for Army field use.

This program was terminated because the system does not meet the Army's requirements for field use. The technical data package is being retained to support any potential future needs.

SECTION III

OBLIGATION REPORT ON ORDNANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARMENT OF THE ARMY

RCS DD-DR&E (SA) 1065

DESCRIPTION OF RDTE EFFORT FOR THE ORDNANCE PROGRAM

During FY83, the Department of the Army obligated $8,955,000 for general research investigations, development and test of smoke, riot control agents and weapons systems.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$	8,955,000	
Prior Year (PY)		-0-	
			In-House $ 7,025,000
TOTAL	$	8,955,000	Contract $ 1,930,000

Breakdown of Program Areas

Smoke Program	$	8,925,000
Riot Control Program		-0-
Test Support	$	30,000

DESCRIPTION OF PAA EFFORT FOR THE ORDNANCE PROGRAM

During FY83, the Department of the Army obligated $13,382,000 for procurement of smoke/obscurants, riot control agents, weapons systems and other support equipment.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$	13,725,000	
Prior Year (PY)		(343,000)	
			In-House $ 2,717,000
TOTAL	$	13,382,000	Contract $ 10,665,000

Breakdown of Program Areas

Smoke/Obscurants Program	$	9,450,000
Riot Control Program	$	668,000
Other Support Equipment	$	3,264,000

ANNEX B

DEPARTMENT OF THE NAVY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

RCS: DD-DR&E (SA) 1065

SECTION 1

OBLIGATION REPORT ON CHEMICAL WARFARE PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARTMENT OF THE NAVY

RCS: DD-DR&E(A)1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983
REPORTING SERVICE: DEPARTMENT OF THE NAVY
DATE OF REPORT: 30 SEPTEMBER 1983
RCS: DD-DR&E(A)1065

DESCRIPTION OF EFFORT: RDT&E	FUNDS OBLIGATED ($ in Millions) PY / CFY	IN-HOUSE / CONTRACT	EXPLANATION OF OBLIGATION
1. CHEMICAL WARFARE PROGRAM	.138 / 20.183	1.364 / 18.819	During the period 1 October 1982 through 30 September 1983, the Navy obligated $20.183,000 for research and development efforts.
a. Defensive Equipment Program	.138 / 10.683	1.199 / 9.484	FUNDS SUPPORT
(1) Chemical Research	0 / .590	.500 / .090	Research for understanding of materials, devices, and analytical techniques needed for chemical warfare defense.
(2) Exploratory Development	.014 / .436	.150 / .286	Development of technology to support the defense requirements in the event chemical agents are employed against Navy or Marine Corps units.
(3) Engineering Development	.124 / 9.657	.549 / 9.108	Development of chemical defensive equipment and systems as necessary to prepare U.S. Navy units to operate in chemical warfare environments.
b. Lethal Chemical Program			
(1) Engineering Development	0 / 9.500	.165 / 9.335	Acquisition of a U.S. Navy retaliatory air-delivered chemical weapon environmentally safe for storage and handling.

SECTION 2

OBLIGATION REPORT ON BIOLOGICAL RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARTMENT OF THE NAVY

RCS: DD-DR&E(A)1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983
REPORTING SERVICE: DEPARTMENT OF THE NAVY
DATE OF REPORT: 30 SEPTEMBER 1983
RCS: DD-DR&E(A)1065

DESCRIPTION OF EFFORT: RDT&E (Cont'd)	FUNDS OBLIGATED ($ in Millions) PY / CFY	IN-HOUSE / CONTRACT	EXPLANATION OF OBLIGATION
2. BIOLOGICAL RESEARCH PROGRAM	0 / 1.097	.650 / .447	
a. Defense Equipment Program			FUNDS SUPPORT
(1) Biological Research	0 / .660	.500 / .160	Research provides understanding of materials, devices, and analytical techniques needed for biological warfare defense.
(2) Exploratory Development	0 / .437	.150 / .287	Development of technology to support the defense requirements in the event biological agents are employed against Navy or Marine Corps units.

SECTION 3

OBLIGATION REPORT ON ORDNANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARTMENT OF THE NAVY

RCS: DD-DR&E(A)1065

NEGATIVE

ANNEX C

DEPARTMENT OF THE AIR FORCE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

RCS: DD-DR&E (SA) 1065

SECTION 1

OBLIGATION REPORT OF

CHEMICAL WARFARE LETHAL AND INCAPACITATING AND DEFENSIVE EQUIPMENT PROGRAMS

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

RCS: DD-DR&E (SA) 1065

DEPARTMENT OF THE AIR FORCE

30 SEPTEMBER 1983

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS
FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1983
RCS: DD-DR&E(SA) 1065

DESCRIPTION OF EFFORT RDT&E	FUNDS OBLIGATED ($ in Millions) PY / CFY	 IN-HOUSE / CONTRACT	EXPLANATION OF OBLIGATIONS
Offensive RDT&E Program			
Research	.000 / .000	.000 / .000	
Exploratory Development	.000 / .000	.000 / .000	
Advanced Development	.000 / .000	.000 / .000	
Engineering Development	.000 / .200	.000 / .200	The BIG EYE binary chemical munition is a joint-development program with the Air Force acting as lead service. The Air Force tests and certifies the weapon's compatability with selected Air Force aircraft.
Total Offensive RDT&E	.000 / .200	.000 / .200	

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS
FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1983
RCS: DD-DR&E(SA) 1065

DESCRIPTION OF EFFORT RDT&E	FUNDS OBLIGATED ($ in Millions) PY CFY	 IN-HOUSE CONTRACT	EXPLANATION OF OBLIGATION
Defensive Equipment Program			
Research	.000 .000	.000 .000	
Exploratory Development	.000 4.418	1.422 2.996	
Advanced Development	-.056 5.391	.567 4.768	
Engineering Development	.589 15.576	3.476 12.689	The program is composed of biological and chemical agent detection, individual protection, collective protection, decontamination and basic operational and medical problems associated with chemical warfare operation.
Total Defensive (RDT&E)	.533 25.385	5.465 20.453	

SECTION 2

OBLIGATION REPORT ON BIOLOGICAL RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARTMENT OF THE AIR FORCE

RCS: DD-DR&E (SA) 1065

30 SEPTEMBER 1983

N E G A T I V E

SECTION 3

OBLIGATION REPORT ON ORDNANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1982 THROUGH 30 SEPTEMBER 1983

DEPARTMENT OF THE AIR FORCE

RCS: DD-DR&E (SA) 1065

30 SEPTEMBER 1983

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